

SPRUCE BUDWORM SITUATION IN OREGON

AND WASHINGTON - 1949 Season

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Portland, Oregon
September 1, 1949

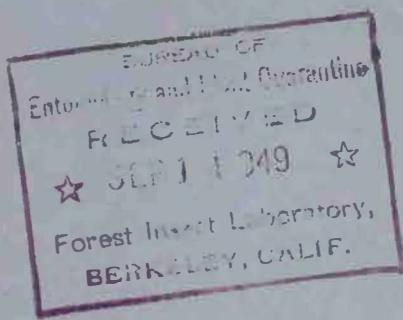


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SPRUCE BUDWORM SITUATION IN OREGON AND WASHINGTON - 1949 SEASON

INTRODUCTION

The spruce budworm epidemic continues to spread in the Douglas-fir and true fir stands of Oregon and Washington. Considerable timber was killed in 1949 in the Blue Mountains region. Extensive stands in the Blue Mountains and to a lesser degree in Western Oregon are threatened with destruction next year. Control of this epidemic is one of the most serious problems of forest protection in the Pacific Northwest.

An extensive aerial and ground survey of the budworm situation in the fir forests of Oregon and Washington has recently been completed through the cooperative efforts of the federal government, the states of Oregon and Washington, and timber owners. The findings of this survey are summarized in the present report to provide the basic information necessary for planning of a control program.

HISTORY

There are few records of spruce budworm outbreaks in Oregon and Washington. The first record of the budworm in these states was in 1914 when one adult was reared from Douglas-fir at Ashland, Oregon. The next record was in 1929 when several small centers of infestation were noted at Northport, Washington. Small outbreaks were observed in 1931 south of Mitchell, Oregon, and in 1941 and 1942 in the Warner Mountains southeast of Lakeview, Oregon. The first outbreak of extensive proportions developed in 1943 in the Methow Valley, Washington, and spread over much of the Chelan National Forest and adjoining areas. In 1948 this outbreak subsided without having caused serious loss of timber.

In 1944 a light infestation of the budworm was discovered on Douglas-fir and true fir on a small area on the Heppner Ranger District of the Umatilla National Forest. An extensive survey of the Blue Mountains in 1947 showed that this outbreak had increased to 710,000 acres. A resurvey in 1948 showed that the outbreak had continued to develop and that 1,243,000 acres were infested in the Blue Mountains. The trees on 37 percent of the affected area were heavily to very heavily defoliated and some trees were being killed.

In 1948 the first recorded outbreak of the budworm west of the Cascade Divide was found on several scattered areas in the general vicinity of Eugene, Oregon. This epidemic outbreak totaled approximately 120,000 acres plus an extensive fringe of light infestation. In 1948 an outbreak of approximately 100,000 acres was discovered on the eastern slopes of the Mount Hood National Forest.

The wide-spread epidemic situation at the end of the 1947 season, combined with the well-known destructiveness of the budworm, indicated an urgent need for control measures to suppress the epidemic.

1/ Buckhorn, W. J. -- Defoliator Situation in the Fir Stands of Eastern Oregon and Washington, Season of 1947. Office report dated February 18, 1948.

2/ Furniss, R.L., Buckhorn, W. J., and Wright, K. H. -- The Spruce Budworm in Oregon and Washington, Season of 1948. Office report dated November 1, 1948.

To meet this need, a large-scale experiment, employing the most promising measures developed in the Northeastern states and Eastern Canada, was conducted from May to July of 1948 on the Heppner District of the Umatilla National Forest. This experiment was a cooperative effort of the Oregon State Board of Forestry, the Bureau of Entomology and Plant Quarantine, the U. S. Forest Service, and the Kinzua Pine Mills Co. It proved that the aerial application of DDT in fuel oil would give upward of 95 percent control when properly timed.

In the fall of 1948 a committee ^{1/}, representing the timber-land owners and the public timber managing agencies met to consider the budworm problem. Taking into account the relative need for control, the timber values involved, the success of the Heppner experiment, the available aerial spraying equipment, and other factors, the committee recommended that control be undertaken in 1949 on the Eugene and Mount Hood areas of infestation. Subsequently funds for these projects were contributed by the federal government, the State of Oregon, and the timber owners.

1/ The committee consisted of representatives of the following agencies and organizations:

West Coast Lumbermen's Association

Western Pine Association

Western Forestry and Conservation Association

Willamette Valley Tree Farms

Weyerhaeuser Timber Company

Fischer Lumber Company

Oregon State Board of Forestry

Oregon Extension Service

U. S. Forest Service

U. S. Bureau of Land Management

U. S. Indian Service

U. S. Bureau of Entomology and Plant Quarantine

In May and June of 1949 a total of 267,000 acres were treated with DDT in oil. Some 161,000 acres were treated on the Eugene area and 106,000 acres on the Mt. Hood area. An average kill of approximately 97 percent was obtained on both areas. These projects, conducted at an average over-all cost of approximately \$1.20 per acre, demonstrated that the budworm can be effectively and economically controlled on extensive areas. These projects also demonstrated the feasibility of conducting considerably larger projects during coming years.

PART I - CURRENT SITUATION

General Statement

The following data regarding the spruce budworm in Oregon and Washington were obtained from a cooperative aerial and ground survey conducted during the period June 15 to August 26, 1949. While some ground checking remains to be done, the over-all picture is essentially complete and all the figures are sufficiently accurate for control planning. For details concerning the organization and conduct of the survey, reference should be made to Part 2 of this report.

The survey of 1949 revealed that the spruce budworm is present to some degree in virtually all the Douglas-fir, true fir, and Engelmann spruce stands of the two states. Only the northwestern counties of Oregon and western Washington are comparatively free of the budworm and even there it is present in very small numbers on extensive areas. The implications of this are that the budworm probably is native to the area and that the current outbreaks are the result of local buildups of populations rather than of mass migrations. This is of significance from the control standpoint in that "complete" coverage is impractical; consequently, more attention can be given to protection of timber in place rather than to preventing spread, except around local centers.

Budworm infestation of epidemic proportions was found in 1949 on 2,232,250 acres, exclusive of the 267,000 acres that were sprayed. Thus there was a 56 percent increase as compared with the 1,432,000 acres of infestation recorded in 1948. The location of the various infested areas is shown on the accompanying map. The degree of infestation by acreages is given in Table 1 and the ownership in Table 2.

The Blue Mountains continue to be the most heavily infested area with a total of 2,103,620 acres of infestation. On the eastern slopes of the Cascades in Oregon there are 39,990 acres of infestation and on the western slopes of the Cascades in Oregon there are 88,640 acres of infestation. In Washington, exclusive of the Blue Mountains, there are no outbreaks.

It should be noted that all acreages given in this report reflect the areas detected from the air. Adjoining these areas are additional acreages of relatively light infestation, not visible from the air, but harboring considerable budworm populations. Since detection lags behind the spread of the budworm, the acreage figures given in this report are conservative, especially in western Oregon where the infested areas are practically all surrounded by large blocks of susceptible forest. In the Blue Mountains the figures are more nearly exact in that the visible budworm infestation extends to the edge of the susceptible type in most cases.

It should also be noted that the ground survey revealed the budworm to be present in small numbers on very large areas outside the limits of infestation visible on the aerial survey. This type of very light infestations is distinct from the "light" infestation on the outbreak areas.

In the following sections the situation is discussed area by area. The degrees of infestation are the same as those used in 1948, except that a "dead" category is added. The degrees of infestation are as follows:

- Light - Defoliation light, mostly on current growth, barely visible from the air.
- Moderate - Defoliation moderate. No mortality expected for at least one year.
- Heavy - Defoliation moderate to severe. Light current mortality. Heavy mortality probable next year.

Very heavy - Defoliation severe. General mortality in progress.

Dead - Defoliation complete. Trees predominantly dead on extensive areas.

Blue Mountains Area

In 1949 the spruce budworm infestation increased both in extent and severity. The cumulative effects of repeated defoliation have become pronounced in many parts of the region and have resulted in severe mortality of stands in two widely separated areas. The infestation now covers some 2,103,360 acres in the following intensities; light - 414,360; medium - 830,740; heavy - 561,640; very heavy - 287,860; dead - 9,020. Intensive ground sampling outside of the visibly defoliated areas indicated that the budworm is present in practically all fir and spruce stands in the Blue Mountains.

The indications are that losses will be considerable from the defoliation that has occurred to date in stands classified as being very heavily defoliated.

Malheur National Forest -- Although the budworm infestation on the Malheur declined to some extent on a number of centers during 1948, it again became aggressive and expanded considerably during 1949. A total of 127,900 acres was mapped as compared with 56,000 acres in 1948. No new centers were found in 1949. While the stands in a few draws were heavily defoliated, the infestation in general was moderate in character. No appreciable losses are anticipated in 1950, hence the need for control is less pressing than on some other areas in the region. The infested stands are of merchantable quality. Ownership is 60.8% federal and 39.2% private, state, and county.

Ochoco National Forest — In 1947 some 15,000 acres of infestation were found on the Snow Mountain District. In 1948 this infestation subsided without causing material damage. In 1949 two new centers were found near Mitchell — one a small area covering some 160 acres near the Ochoco Summit and a larger area on the Waterman District covering some 13,600 acres. Light infestation prevails in both of these centers; consequently there is no danger of any tree killing in 1950 and the need for control is relatively low. The fir timber on the infested area is generally of poor quality. Ownership is 9 percent federal and 91 percent private, state, and county.

Umatilla National Forest — The Umatilla National Forest and adjoining areas continue to harbor the most extensive infestation of the budworm in the region. Beginning from a very small start in 1944, the infestation increased to 374,000 acres to 1947, to 807,000 acres in 1948, and to 1,148,010 acres in 1949. The acreage breakdown of the 1949 infestation by degree of defoliation is as follows: light - 145,490; moderate - 391,800; heavy - 335,930; very heavy - 271,210; and dead - 3,580. Ownership is 61 percent federal and 39 percent state, county and private.

The situation on the Umatilla is highly critical. The first extensive loss of merchantable timber has occurred on some 3,580 acres in three canyons on Tamarack Mountain. These trees died as a result of repeated heavy defoliation in 1947 and 1948. Equally heavy defoliation occurred during 1948 and 1949 on many portions of the 271,210 acres classified as being very heavily defoliated. Tree mortality is expected to be heavy in these stands from the defoliation that has occurred to date. In addition the Douglas-fir

beetle has begun to attack the weakened Douglas-firs extensively, thus adding to the destruction caused by the budworm.

Much of the infestation on the northern part of the forest is in stands that are predominantly of low value, largely due to the rugged terrain and in many cases the subalpine character of the timber. Destruction of the stands protecting the watersheds which supply the communities of Walla Walla, Milton and Freewater is well under way. Stands of high aesthetic value in the intensively used Tollgate recreation area were heavily defoliated during the past season but may survive one more year of defoliation.

Control on the Umatilla National Forest ranks high in the order of priority for the region. Very large acreages of infestation are involved and economic considerations will determine which should be treated and which left untreated. It is considered preferable at this stage of the outbreak to concentrate on stands where mortality is in progress rather than to treat entire blocks irrespective of the degree of devoliation.

Umatilla Indian Reservation -- In 1948 the spruce budworm was present on a small area in the northeastern part of the Umatilla Indian Reservation. In 1949, approximately 7,780 acres of scattered, low quality timber were infested. Some 6,070 acres of light defoliation are present on the southeastern end of the reservation and 1,710 acres of very heavy defoliation are present on the north-eastern end. Some tree mortality is in progress on the very heavily infested area. The control problem is essentially a part of that on the adjoining Umatilla National Forest.

Wallowa National Forest -- During 1949 the infested acreage on and adjacent to the Wallows more than doubled, amounting to some 465,480 acres as compared with 227,000 infested acres in 1948. This increase is largely accounted for by a new center discovered in the better stands on Grossman Creek, the extension of the Day Ridge center southwest into Mud Creek; and the expansion and merging of many small areas in the low value stands in the Snake-Imnaha river drainages. The acreage breakdown by degree of defoliation is as follows: light - 138,480; moderate - 183,290; heavy - 143,710. The increase of heavy infestation was very great as there were but 4,500 acres in this category in 1948; Ownership is distributed as follows: Forest Service - 332,360 acres; state, private, and other - 133,120 acres.

As yet no appreciable kill has occurred on the Wallowa. Considerable, but not excessive kill can be expected in 1950, provided the outbreak continues at its present high level. The situation is not so critical as in other parts of the region, and, in view of the needs elsewhere, it may not be feasible to undertake control on the Wallowa in 1950.

In July of 1949 a noteworthy experiment was undertaken on the Day Ridge area of the Wallowa. This experiment, undertaken cooperatively by the Oregon State Board of Forestry, the U. S Forest Service, and the Bureau of Entomology and Plant Quarantine, was to determine whether the spraying period for control of the budworm could be extended by spraying against the summer migration

of newly hatched larvae. Some 3,000 acres were treated with three different insecticides. The results will not be known until the spring of 1950.

Whitman National Forest -- On the Blue Mountains Division of the Whitman the infestation covers some 49,480 acres, an increase of 6,480 acres over the 1948 figure. The increased acreage largely resulted from infestation developing in the scattered patches of fir, largely second growth, in canyons and on benches along the east slope of the mountains extending from La Grande to Baker. The intensity of the infestation is distributed as follows: light - 6,691; medium - 27,230; heavy - 15,560. Little or no mortality has occurred to date and it appears reasonable to delay control measures.

On the Minam Division the infested acreage now totals 276,189 acres, an increase of 156,190 acres above the 1948 figure. Unbroken infestation extends from the Wallows River south to Eagle Creek. From Eagle Creek intermittent infestation occurs in the various canyons east to North Pine Creek where it again becomes continuous, extending along the top of the Snake Canyon to join the large area on the Wallowa Forest. Much of the infested area is in second growth on logged over lands or in stands at high elevations which are subalpine in character.

The acreages of various degrees of infestation are as follows: light - 103,789; medium - 100,520; heavy - 66,440; very heavy - 14,940; dead - 5,440. The loss of timber occurred largely in second growth on the east slope of Clark Mountain. Undoubtedly a high percentage of the stands on the 14,940 acres of very heavy

defoliation, largely in the Catherine Creek drainage, will fail to put forth new growth next spring. Whether the critically infested stands of this area are of sufficient value to warrant control is a matter to be determined in relationship to the needs elsewhere in the region.

The ownership of the infested areas on the Whitman at large is as follows: Forest Service - 218,460; state, county, and private - 122,150.

Eastern Oregon Cascades

The first record of budworm infestation in this region, which for purposes of this report includes the eastern slopes of the Cascades and the southern Oregon forests extending to the Warner Mountains, was in 1948 when an outbreak of approximately 100,000 acres was found on the Mt. Hood National Forest and Warm Springs Indian Reservation. This outbreak was sprayed in the spring of 1949. In 1949 some light infestation developed around the sprayed area and three new spots showed up on the Deschutes National Forest making a total of 39,990 acres of infestation. All of the current infestation is light except for 7000 acres of moderate infestation on the Deschutes.

A total of 189 ground samples showed the budworm to be present at 73 points outside the areas of visible defoliation. Very light infestation was noted on white fir in the Warner Mountains on the Fremont National Forest. In addition to the infestation in the outbreak centers, the budworm was also present in small numbers on Douglas-fir and white fir on most parts of the Deschutes National

Forest, the Warm Springs Indian Reservation, and the eastern part of the Mount Hood National Forest.

The situation by areas is as follows:

Mount Hood National Forest -- Immediately west of the control area and to the north of White River some 7470 acres, predominantly National Forest land, are lightly defoliated. No tree mortality is threatened next year; however, the presence of this nucleus of infestation, together with that on the nearby Warm Springs Indian Reservation, continues to threaten adjoining high-value stands. It appears logical to suppress this threat and thereby complete the control program begun in 1949.

Warm Springs Indian Reservation -- Adjoining the Mount Hood control area to the south are 25,520 acres of light infestation on the Warm Springs Indian Reservation. The control problem is intimately tied in with that on the Mount Hood forest and the same considerations apply.

Deschutes National Forest -- Three centers of moderate defoliation totaling 7000 acres were found on the Sisters area of the Deschutes in 1949. The largest and most aggressive center, covering 4,050 acres is adjacent to the north side of the Suttle Lake recreational area. No tree killing is anticipated in 1950 and, since the budworm is already generally distributed on the Deschutes, control is of relatively low priority.

Western Oregon

In Western Oregon the 161,000-acre control project in May and June of 1949 appears to have checked the outbreak on the sprayed areas. New outbreaks have developed on 88,640 acres outside of

the control area, principally on National Forest land. All degrees of infestation from light to very heavy are present in the new centers. Considerable tree mortality, especially in the younger stands, is expected if the infestation continues at its present high level.

The ground checking in 1949 showed that the budworm is widely distributed in the Douglas-fir and true fir stands of western Oregon. Of a total of 1898 widely taken ground samples, 341 showed evidence of the budworm. The only samples showing infestation of epidemic proportions were taken along the south fork of the McKenzie, and the north fork of the Willamette rivers. The greatest concentration of sample plots showing budworm presence was on the area bounded on the north by the North Santiam River, on the south by the South Fork of the Umpqua River, on the east by the Cascades and on the west by the Coast Range. Elsewhere the infestation is so low that evidences of the budworm were picked up only occasionally.

In view of the intensity of infestation and the high values threatened by the infested areas in western Oregon, immediate control seems desirable on all units with the possible exception of the Roseburg-Wilbur unit.

A unit by unit description of the western Oregon area follows:

McKenzie Bridge Unit -- This unit comprises the largest block of infestation with a total of 33,600 acres, all federally owned. The stand consists principally of large second-growth Douglas-fir with a scattering of patches of smaller Douglas-fir and white fir.

The infestation is found from an elevation of about 2,000 feet to 5,000 feet, where the Douglas-fir gives way to various alpine species. This area is immediately adjacent to very large stands of virgin timber. The Blue River Experimental Forest with its intensive research development is less than 15 miles distant. Very heavy defoliation is present on 960 acres and heavy defoliation on 1,760 acres of some of the best timber. The remaining infested acreage is of light to moderate intensity. Considerable tree mortality can be expected on the heavily defoliated areas next year with top killing on those of lighter intensity. In western Oregon the McKenzie Bridge infestation is the greatest potential threat because of the very high volume of adjacent stands.

South Fork McKenzie River Unit -- Some 21,280 acres of infestation were mapped on this area of National Forest land, with 5,600 acres of very heavy defoliation recorded. Engelmann spruce as well as Douglas-fir and white fir have been damaged to various degrees. It is believed that some of the most heavily defoliated small trees will not recover from the attacks to date. Like the McKenzie Bridge infestation the defoliated stands consist principally of small poles, large poles, and small to medium sized saw timber. The virgin stands of old-growth timber, although affected to some degree, do not appear to have been hit as hard as the younger age classes. The infested zone extends from 2,000 to 5,000 feet in elevation where the less susceptible alpine types are found. High volume virgin stands occur immediately south of the infested zone.

North Fork Willamette River -- Although essentially a continuation of the infestation on the south fork of the McKenzie, this area

of 13,200 acres is discussed separately as the headwaters of a different large drainage are involved. This area is also located wholly on the Willamette National Forest. Defoliation intensities in the mixed stands of Engelmann spruce, Douglas-fir and white fir range from 8,640 acres of moderate infestation to 4,640 acres of heavy infestation at elevations of 2,600 to 5,000 feet. The timber size ranges from reproduction to large poles and small sawtimber. Some of the infested timber is on steep rocky slopes and is inaccessible for logging, but supports infestation nevertheless. This area, located at the source of the north fork of the Willamette River, looks over the entire drainage of high volume, untapped virgin timber.

Oakridge Unit -- Here a total of 7,040 acres are infested on three small areas located only a short distance from two small areas that were sprayed the past spring. Successful control was effected on the sprayed areas; but these units, apparently lightly infested in 1948, had increased to moderate intensity by 1949 and were readily discernible from the air. The infested stands consist principally of small second growth with the exception of the area northeast of Hardesty Mountain where some medium sized saw timber is found. The ownership pattern on the unit shows 5,440 acres of federal and 1,600 acres of private land.

Springfield Unit -- This area, 3,200 acres in size and privately owned, is located approximately five miles south of the edge of the main area of the large spray project of 1949. The infestation, of moderate to heavy intensity, is confined to a narrow strip of more

or less isolated small saw timber situated between the Mohawk River and Camp Creek. This area has special significance in that it is a potential source of reinestation for the sprayed stands.

Roseburg-Wilbur Unit -- These two small areas, totaling 10,240 acres, ranging from light to heavy defoliation, are situated near the confluence of the North Umpqua and Umpqua Rivers slightly north of Roseburg. The infested trees are of generally small size and poor quality typical of the foothills of this locality. The acreage figure as given is somewhat misleading in that only the north and east slopes of the hills are timbered with susceptible type, in this case Douglas-fir. The south and west slopes have a coverage of scrub oak and madrona. However, the two types of ground cover are dispersed in such a manner that aerial spraying would necessarily have to be carried out on the entire area to insure satisfactory control.

Western Washington

The aerial survey of Western Washington is not yet completed; however, the areas most likely to harbor infestation have been flown. No infestation visible from the air has been found.

A ground survey covering all major stands of Douglas-fir and true fir in Western Washington yielded no evidence of epidemic infestation by the budworm. Of a total of 1,172 sample plots, 31 showed evidence of the budworm. All samples that showed evidence of the budworm were taken between U. S. Highway 99 and the Cascade Divide but extending in localized patterns from the Columbia River to the Canadian border. In northern Washington very light infestations were found along the Nooksack, Skagit, and Stillaguamish rivers. To the south similarly light infestations were found on the Fort Lewis Military Reservation, and in the Deschutes, Upper Nisqually, Cowlitz, Toutle, Ceweeman, Kalama, and Lewis river drainages.

Eastern Washington (Exclusive of the Blue Mountains)

The aerialsurvey of eastern Washington revealed no burworm outbreaks visible from the air. It is evident from this that there is no present need for control.

The ground crews operating in eastern Washington found evidences of the budworm to be rather prevalent but in no case was there epidemic infestation. On the 28 sample plots taken, the budworm was recorded on 111. No evidence of the budworm was found south of the Yakima Indian Reservation. The budworm was observed at many places on the Yakima and Colville Indian Reservations and the Snoqualmie, Wenatchee, and Chelan National Forests. Although still somewhat heavier than on other areas in eastern Washington, the infestation on the Chelan appears to have subsided to a near normal level following the outbreak of 1943 to 1948. The drainages in which the budworm was found most commonly in 1949 in eastern Washington were as follows:

Chelan National Forest Wenatchee National Forest Colville Indian Reservation

Twisp River
Methow River
Chewack River
Toroda Creek
Myers Creek

Entiat River
Mad River

San Poil River
Nespelem River

Recommendations

Before definite recommendations for the 1950 control program can be made, exact information as to available funds, equipment and personnel will be required. However, it is already apparent that the gross area in need of immediate treatment is too great for a single year's operation, and decisions will have to be made on area priorities.

In making these decisions it is recommended that areas in which immediate heavy kill of valuable timber stands is probable, and infested areas which threaten adjacent valuable timber stands be given priority over all other infested areas.

SURVEY METHODS AND PROCEDURES

General Statement

With the continued spread of the spruce budworm epidemic over a wide area, it became evident that a complete knowledge of the budworm situation in Oregon and Washington was needed. Aerial surveys conducted in 1947 and 1948 showed the location of the main centers of epidemic infestation; however, only those infestations of sufficient intensity to be seen from the air were recorded. In order to determine the absolute limits of infestation, it was evident that an extensive ground survey was needed to supplement the aerial survey. The objectives of such a ground survey were to : (1) Record the extent of the infestation, (2) Establish observation points for recording the year to year change of infestation, and (3) Provide a guide for the aerial survey.

In view of the highly successful spray projects in 1949, general interest in a region-wide program for controlling the budworm was aroused. In order to obtain the best possible information for control planning, the survey program described in this report was undertaken. Due to the magnitude of the task, it was obvious that a cooperative effort involving a large number of personnel would be necessary to supply a full picture of the budworm situation in Oregon and Washington during the short period when visible evidence of defoliation is present. As a result, representatives of state, federal and private forest interests pooled their efforts to obtain the desired information. The nature of the cooperative effort is described in the following sections of this report.

Although this report is confined to the spruce budworm situation, it should be noted that all abnormal insect activity, as well as other stand disturbances, encountered on the aerial surveys were mapped and recorded. The afflicted areas will be ground checked, the cause and extent of damage recorded, and control recommendations made, if needed. These data will be submitted in a later report on general forest insect conditions in Oregon and Washington.

The statistics for the operational phases of the aerial and ground surveys conducted in 1949 are given in tables 3 through 10 in the appendix of this report.

Ground Survey in Western Oregon

The initial move to get a region-wide ground survey underway was made when a meeting of Western Oregon industrial foresters was called at the Eastern Lane Fire Patrol Headquarters at Springfield. The meeting was called and directed under the joint leadership of Assistant State Forester John B. Woods, Jr. and Robert L. Furniss, entomologist in charge of the Forest Insect Laboratory at Portland. The following agencies and organizations were represented: Crown-Zellerbach Corporation, Willamette Valley Tree Farms, Booth-Kelly Lumber Company, Weyerhaeuser Timber Company, Fischer Lumber Company, Oregon State Board of Forestry, Bureau of Land Management, Long-Bell Lumber Company, U. S. Forest Service, U. S. Indian Service, and Bureau of Entomology and Plant Quarantine. All present expressed their desire to partake in a survey. It was stated that many company and agency foresters had spent much time investigating their lands, but needed advice on recognition of the insect and a standardized

manner of submitting findings. With assurance of full-scale cooperation on the survey an organized plan of action was worked out. A short orientation course on recognition of the insect was held to differentiate between the budworm and other similar insects that might be encountered in the ground checking. Colored slides showing the extent and potential destructiveness of the insect were shown.

It was agreed that foresters representing the various organizations and agencies would examine their holdings in a prescribed manner. To insure complete coverage of the area, this work was coordinated under the leadership of the State Conservation inspectors in charge of the conservation districts of Western Oregon. Any areas not covered by private or government foresters were to be examined by the inspectors. A crew of nine Forest Service men under the direction of J. M. Whiteside of the Bureau of Entomology was assigned the job of covering the National Forests. This task was later extended to all National Forests in Oregon and Washington.

In order to obtain uniform results from a diversity of sources, mimeographed forms (see examples in appendix) were provided to all participants. These forms consisted of two sheets of general instructions and a blank form for recording data. The procedure in general involved taking a series of roadside samples; the sample locations being spaced one to three miles apart along roads; the frequency of sampling being determined by change of timber type, age class, exposure and other factors that might affect the susceptibility of stands to budworm attack. At each plot location, a sample

of prescribed size was taken, an examination made, and the data recorded on the standard form. A collection of budworm specimens, if found, was made at least once in each drainage and correlated with the recorded data. In addition a map was kept by each observer to show the exact locations of the samples. All collected data -- forms, maps, and insect specimens were sent to a field laboratory at the Eastern Lane Fire Patrol Headquarters at Springfield. At this point A. Lindsten of the State Forestry Department and K. H. Wright of the Bureau of Entomology correlated the submitted data, examined insect specimens and established the presence or absence of budworm, and recorded the plot locations on a master map.

Two subsequent orientation meetings were held at Scottsburg and Molalla, Oregon to contact foresters not in attendance at the Springfield meeting. Representatives of the State Forestry Department advised those in attendance as to the survey methods to be employed.

The ground survey in western Oregon got underway on June 15, and continued until the first week of July. Cooperators showed great initiative in examining their holdings, and in many cases covered small-ownership areas outside their own territory. Under the guidance of the State Conservation Inspectors the huge acreage to be covered was examined rapidly and with a minimum of repetition. The inspectors checked many areas in between larger ownerships, and to these men goes a great deal of credit for the success of the undertaking.

A variety of insects were collected by the participating members:

By this time - late June - most of the larvae had pupated and on many areas the adults had emerged. As many lepidopterous pupae superficially resemble the budworm, there was some confusion in the field as to the identity of the specimens found. Likewise various larvae that appeared to resemble budworm were encountered. It became evident from the discovery of insects similar to the spruce budworm that perhaps the most important phase of the field work was the collection of insect specimens. Without the collections that accompanied the plot data, the technicians stationed at Springfield would have been unable to positively verify the presence or absence of budworm as recorded by the field men on the standard forms.

Ground Survey in Western Washington.

Following the Springfield meeting foresters of Weyerhaeuser Timber Company's research staff found evidence of very light infestation on their ownership near Rainier, Washington. As a result of these findings, state and private foresters of southwestern Washington called a meeting at Longview, Washington, June 28th, to discuss plans for a cooperative survey such as was being carried on in western Oregon.

About 25 men, consisting of state fire wardens, and private foresters, attended. D.N.Jeffers of Weyerhaeuser Timber Company headed the meeting with J.R.Whiteside of the Bureau of Entomology supplying the technical information. It was unanimously agreed that information on the presence or absence of the budworm in western Washington stands was definitely needed. The state men and company foresters accepted various designated areas to be covered as their part of the undertaking. The National Forests were covered by two three-man crews employed by the Forest Service. Good coverage of southwestern

Washington was thus obtained. Techniques and methods followed were essentially the same as those used on the Oregon survey. All samples, maps and insect specimens were coordinated at Portland by Whiteside.

To complete the ground survey of the fir stands in western Washington a subsequent meeting of forest officials from northwestern Washington was called on July 7th at Seattle by W.D. Hagenstein, forest engineer of the West Coast Lumberman's Association. A good response was obtained with thirty-two private, state and federal foresters in attendance. A standardized survey program, under the technical direction of J.M.Whiteside of the Bureau, similiar to that formed at Springfield and Longview was organized. All data collected by cooperators were sent to Whiteside at the Bureau Laboratory in Portland for processing. Good coverage was achieved through this cooperative effort.

The ground survey of western Washington proceeded in much the same manner as the cooperative survey in western Oregon. With the great number of foresters participating in the effort, practically all the proposed area was covered by July 15. The task of coordinating the numerous work sheets, maps and insect specimens proved to be a lengthy one and has only recently been completed. A great variety of insects were received and again the value of the submitted specimens on a survey of this type was apparent; more often than not the identity of the vialized insects determined the presence or absence of spruce budworm on any particular area. The cooperators are to be commended on the speed with which the large undertaking was accomplished and the quality of the maps, notes and specimens submitted.

Ground Survey in Eastern Oregon and Washington.

As the bulk of fir stands in eastern Washington and eastern Oregon are in the National Forests, the job of ground checking was assigned to the Forest Service crews employed for insect detection work. The same procedures were used as in western Oregon and Washington. In addition to the National Forests, the J. Neils Lumber Co. holdings in the vicinity of Klickitat, Washington, and the Colville, Yakima, Warm Springs and Klamath Indian Reservations were also examined. The only east side forests in the two states not covered by ground or aerial surveys were those in the northeastern Washington counties of Spokane, Pend Orielle and Stevens. This area is under the jurisdiction of Region 1 of the Forest Service and the Forest Insect Station at Cœur D'Alene, Idaho.

Aerial Surveys in Oregon and Washington.

Through a cooperative agreement between the Oregon State Board of Forestry, the U.S. Forest Service, and the Bureau of Entomology and Plant Quarantine, an aerial survey of the insect situation on all forested lands in Oregon and Washington was undertaken. This survey is completed except for a few hours of flying in the coastal region of Washington. The State of Oregon furnished an airplane and personnel, with the exception of one man provided by the Bureau, for coverage of the western half of Oregon, Oregon east of the Cascade Divide, and all of Washington, were covered by a plane provided by the U.S. Forest Service and manned by personnel supplied by the Bureau of Entomology.

Bids were let by the Forest Service and the State to procure aircraft for the survey. A two-place Luscombe was secured for the eastern Oregon-Washington survey and a four-place Cessna "170" for the Western Oregon surveys. The addition of a third member to the

Oregon-Washington crew midway in the survey resulted in obtaining a "170" for that group also. While waiting for bids to be processed, a Stinson Station Wagon and a Cessna "170" were rented for two days each, on a by-the-day basis by the western Oregon crew. The Cessna proved to be very suitable for the survey work due to its good visibility features, stability and general airworthiness.

Aerial survey methods employed by the two parties closely followed those developed by Buckhorn & Wear of the Bureau in their eastern Oregon insect surveys of 1947 and 1948. All major forest types were intensively covered either by "conturing" or "gridironing" and all infestations were sketch mapped in place according to degree of infestation. In order to insure complete coverage of all areas, and to keep oriented with ground locations at all times, flight lines were plotted as the survey progressed.

The aerial survey of western Oregon was started July 6th and completed August 1, 1949. This was found to be nearly ideal timing both as to general visibility and the color phase of the attacked trees. The western Oregon sector was divided into four operating units so as to accomplish the most with a minimum of ferry time. The bases selected were Salem, Eugene, Roseburg and Medford. As usual in western Oregon weather was the governing factor and some shifting from one base to another was done to take advantage of clear weather in one area while poor visibility existed in another. This was particularly true of the Eugene area where the survey crew left from the Eugene base for the Roseburg and Medford bases and later returned to finish the Eugene area.

The aerial survey of western Oregon was accomplished by the following personnel: Kenneth Wright, observer, Bureau of Entomology; James Brigham, pilot; and Alvin Lindsten, observer, of the Oregon State Board of Forestry. Some additional help was obtained from local foresters who were more familiar with particular areas. The operational phases of the western Oregon aerial survey are summarized in tables 3 and 4.

The aerial survey of the Blue Mountain region got underway early in July. From there the survey progressed to southeastern Oregon, Central Oregon, eastern Washington, and finally western Washington where the concluding phases are still in progress. Because of the large areas to be covered by a single crew the survey period on these areas was more prolonged than was desirable; however, it is felt that no significant infestations of the budworm were missed.

The aerial survey of Washington and eastern Oregon was made by J.F. Lear, J.Buckhorn, and R. Heller of the Bureau of Entomology and Plant Quarantine. The operational phases of the survey are summarized in tables 3 and 4.

TABLE 1 - SUMMARY OF SPRUCE BUDWORM SITUATION BY INTENSITY OF INFESTATION - 1949

1/

Locality	INTENSITY OF INFESTATION										Total Acres	% Total
	Light		Moderate		Heavy		Very Heavy		Dead			
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS												
Umatilla N. F.	145,490	12.7	391,800	34.1	335,930	29.3	271,210	23.6	3,580	0.3	1,148,010	100
Wallowa N. F.	138,480	29.7	183,290	39.4	143,710	30.9					465,480	100
Whitman N. F.	110,480	32.4	127,750	37.5	82,000	24.1	14,940	4.4	5,440	1.6	340,610	100
Malheur N. F.			127,900	100							127,900	100
Ochoco N. F.	13,840	100									13,840	100
Umatilla Ind. Res.	6,070	78.0					1,710	22.0			7,780	100
Subtotal	414,360	19.7	830,740	39.5	561,640	26.7	287,860	13.7	9,020	0.4	2,103,620	100
EASTERN CASCADES												
Deschutes N. F.			7,000	100							7,000	100
Mt. Hood N. F.	7,470	100									7,470	100
Warm Springs Ind. Res.	25,520	100									25,520	100
Subtotal	32,990	82.5	7,000	17.5							39,990	100
WESTERN OREGON												
McKenzie Bridge	20,800	61.9	10,800	30.0	1,760	5.2	960	2.9			33,600	100
S. Fork McKenzie			14,400	67.7	1,280	6.0	5,600	26.3			21,280	100
N. Fork Willamette				8,640	65.0	4,640	35.0				13,280	100
Oakridge	1,280	18.2	5,760	81.8							7,040	100
Springfield	800	25.0	960	30.0	1,440	45.0					3,200	100
Roseburg-Wilbur	4,400	42.9	5,360	52.4	480	4.7					10,240	100
Subtotal	27,280	30.8	45,200	50.9	9,600	10.9	6,560	7.4			88,640	100
TOTAL	474,630	21.2	882,940	39.6	571,240	25.6	294,420	13.2	9,020	0.4	2,232,250	100

1/ Does not include 267,000 acres treated in spring of 1949.

TABLE NO. 2

1/

SUMMARY OF SPRUCE BUDWORM INFESTATION BY OWNERSHIP CLASSES - 1949

Locality	OWNERSHIP							
	Forest Service		Indian Service		State & Private		Total	
	Acres	%	Acres	%	Acres	%	Acres	%
<u>BLUE MOUNTAINS</u>								
Umatilla National Forest	699,260	60.9			448,750	39.1	1,148,010	100
Wallowa "	332,360	71.4			133,120	28.6	465,480	100
Whitman "	218,460	64.1			122,150	35.9	340,610	100
Malheur "	77,800	60.8			50,100	39.2	127,900	100
Ochoco "	1,240	9.0			12,600	91.0	13,840	100
Umatilla Indian Reservation			7,780	100			7,780	100
Subtotal	1,329,120	63.2	7,780	0.4	766,720	36.4	2,103,620	100
<u>EASTERN CASCADES</u>								
Deschutes National Forest	6,070	86.7			930	13.3	7,000	100
Mount Hood	7,000	93.7			470	6.3	7,470	100
Warm Springs Indian Reservation			25,520	100			25,520	100
Subtotal	13,070	32.7	25,520	63.8	1,400	3.5	39,990	100
<u>WESTERN OREGON</u>								
McKenzie Bridge	33,600	100					33,600	100
South Fork McKenzie	21,280	100					21,280	100
North Fork Willamette	13,280	100					13,280	100
Oakridge	5,440	77.3			1,600	22.7	7,040	100
Springfield					3,200	100	3,200	100
Roseburg-Wilbur					10,240	100	10,240	100
Subtotal	73,600	83.0			15,040	17.0	88,640	100
TOTAL	1,415,770	63.4	33,300	1.5	783,160	35.1	2,232,250	100

1/ Does not include 267,000 acres treated in spring of 1949.

TABLE 3 SPRUCE BUDWORM AERIAL SURVEY RECORD - 1949

Area	Timbered Acres Covered	Air Miles Flown	Mapping Hours	Ferry Hours	Total Hours	Cost Per Area
Blue Mountains	6,963,975	3,460	27.8	8.6	36.4	\$ 247.62
Eastern Oregon Cascades	6,590,480	2,720	21.8	6.8	28.6	194.53
Western Oregon	15,670,425	7,580	61.5	3.9	65.4	866.97
Western Washington	8,063,685	2,960	22.1	5.6	27.7	273.99
Eastern Washington	8,001,109	3,180	24.9	3.5	35.2	317.92
Totals	45,289,674	19,900	158.1	28.2	186.3	\$1901.03

TABLE 4 SURVEY AIRCRAFT OPERATIONAL RECORD - 1949

Aircraft	Horsepower	Cruising M.F.H.	Flying Time	Rental & Operational Cost	Cost/Hr.
Luscombe T&F (1820B)	90	95	80.8	\$ 549.71	\$ 6.80
Cessna 170 (9276A)	145	115	40.3	484.35	12.02
Cessna 170 (9003A)	145	115	49.9	649.98	13.02
Cessna 170 (2564V)	145	115	9.4	134.16	14.00
Stinson Station Wagon (6316W)	165	120	5.9	82.83	14.00
Totals			186.3	\$ 1901.03	\$ 10.20 Ave/Hr.

TABLE 5 - SUMMARY OF GROUND SAMPLES

Area	Number of Sample Plots		
	Budworm Present	Budworm Absent	Total
Blue Mountains	116	41	157
Eastern Oregon Cascades	73	116	189
Western Oregon	341	1,557	1,898
Western Washington	31	1,141	1,172
Eastern Washington	111	107	218
TOTALS	672	2,962	3,634

SUMMARY OF GROUND SURVEY PLOTS - 1949 SEASON

TABLE 6 - BLUE MOUNTAINS REGION*

Area	Agency	Observer(s)	Symbol	Examination Dates (Incl.)	No. Plots		
					Budworm Present	Budworm Absent	Total
Ochoco N.F.	USFS	Crew: C. Wray J. Zeller P. Dinehart	C	7/20-7/22	28	6	34
Malheur N.F.	"	"	"	7/14-7/18	34	19	53
Whitman N.F.	"	"	"	7/9- 7/13 Subtotal	54 116	16 41	70 157

*Note: Sampling confined to areas not previously recorded as being infested.

TABLE 7 - EASTERN OREGON CASCADES

Fremont	USFS	Crew: C.Wray J.Zeller P.Dinehart	C	6/24-6/25	3	46	49
Deschutes N. F.	"	"	"	6/27-6/30	39	51	90
Klamath Ind. Res.	"	"	"	6/21-6/23	3	19	22
Warm Springs Ind. Res.	"	Crew: D. Johnson E. Sullivan H. Haglund	B	7/5-7/6	28	0	28
				Subtotal	73	116	189

TABLE 8 - WESTERN OREGON

Area	Agency	Observer(s)	Symbol	Examination Dates (Incl.)	No. Plots		
					Budworm Present	Budworm Absent	Total
Conservation Unit I							
Clatsop Co.	State Forestry Dept.	J. F. Gartz	G	6/22-6/29	11	85	99
Columbia Co.	" " "	E. Hooven	V	6/28-	1	10	11
Tillamook Co.	" " "	W. F. Sargent	S	6/27-6/29		39	39
Washington Co.	" " "	B. Hayes	P	6/22-6/29		62	62
N½ Yamhill Co.	Crown-Zellerbach Corp.	Goodmanson	K	6/26-6/27		49	49
	" " "	C. Collard	N	6/23-6/24		14	14
	" " "	M. A. Mosar	O	6/27-6/28		25	25
	" " "	R. C. Lindsay	L	6/23-6/27	1	24	25
	Long Bell Lbr. Co.	W. H. Daudistel	R	6/30		6	6
Conservation Unit II							
S½ Yamhill Co.	State Forestry Dept.	A. Fisher	H	6/23	2	29	31
	" " "	J. Brigham	D	6/17-6/28	31	75	107
Polk Co.	Willamette Vy. Lbr. Co.	R. DeCamp	E	6/21-6/24	1	11	12
Lincoln Co.	Long Bell Lbr. Co.	T. Grover	R	6/28		7	7
Benton Co.	Willamette Vy. Tree Farms	Stoebig, Bradshaw	F	6/29		16	16
	Willamette Vy. Tree Farms	Bronson, Kjosness	F	6/24-6/29		18	18
	State Forestry Dept.	L. R. Fick	H	6-		6	6
Conservation Unit III							
Clackamas Co.	State Forestry Dept.	Ed Hooven	V	6/23-6/27	13	29	42
Marion Co.	Weyerhaeuser T. Co.	Johnson & Downer	J	6/23-6/29	9	43	51
Multnomah Co.	" " "	R. H. Kummer	I	6/23-6/24		41	41
		W. G. Corbitt	C-Z	6/23-6/27		19	19
	Crown-Zellerbach	K. W. Clark				11	11
		G. H. Harrington	C-Z	6/23		3	3
		K. W. Clark	C-Z			6	6
		R. M. King	C-Z	6/24		10	10
		G. H. Harrington	C-Z	6/24		2	2
		W. W. Woodworth	C-Z	6/24			

TABLE 8 - WESTERN OREGON (Cont'd)

Area	Agency	Observer(s)	Symbol	Examination Dates (Incl.)	No. Plots		
					Budworm Present	Budworm Absent	Total
Conservation Unit IV							
Linn Co.	State Forestry Dept.	A. Byrd	B	6/24-7/1	7	36	43
	" " "	G. Wanock, A. Byrd	M	6/20-6/22	7	21	28
	Weyerhaeuser T. Co.	C. Price, J. E. King	W	6/22	5	4	9
	" " "	Smyth, Ellis & Dizard	X	6/22	6	6	12
	Willamette Vv. Tree Farms	P. Sanders & G. Bradshaw	F	6/21-6/22	3	10	13
	Willamette Vv. Tree Farms	Seymour	F	6/21	3	5	8
	Willamette Vv. Tree Farms	Koeltgen & Lefores	F	6/21-6/29	1	10	11
Conservation Unit V							
Lane Co.	State Forestry Dept.	G. Manock	M	6/23-7/1	10	38	48
	" " "	A. Byrd	M	6/27-6/28	5	9	14
	Long Bell Lbr. Co.	C. Foster	F	6/21-6/30		21	21
	Bu. Land Management	O. Kruger	OK	6/17-6/24		36	36
	Long Bell Lbr. Co.	D. Campbell	D	6/21-6/30	42	20	62
	Booth-Kelly Lbr. Co.	F. Sandoz	BK	6/15-6/24	31	1	32
	Fischer Lbr. Co.	W. Wilt	W	6/20	5		5
	Weyerhaeuser Timber Co.	J. E. King	W	6/23	6	3	9
	" " "	C. Price	W	6/23	1	7	8
	Bu. of Land Management	J. W. Watts	A	6/20-6/22	3	13	16

TABLE 8 - WESTERN OREGON (Cont'd.)

Area	Agency	Observer(s)	Symbol	Examination Dates (Incl.)	No. Plots		
					Budworm Present	Budworm Absent	Total
Conservation Unit VI							
NW ¹ Douglas Co.	State Forestry Dent.	G. Hoffman	Y	6/22-7/5	8	101	109
Coos Co.	" " "	G. Smith	DD	6/21-6/23		39	39
Curry Co.	Bureau Land Mgm't.	Rutquist	AA	6-		5	5
Siuslaw N. F.	" " "	Burnette					
		C. Dubvar	FF	6/22		16	16
Siskiyou N. F.	Weyerhaeuser T. Co.	Smyth, Ellis, Dizard	X	6/18-6/26	19	26	45
	Long-Bell Lbr. Co.	W. B. Read	EE	6/20-6/28	2	50	52
	Irwin-Lyons Lbr. Co.	D. Fisher	BB	7/3-7/5		11	11
	Coos County For. Dept.	A. F. Moorehead	CC	6/23		16	16
Conservation Unit VII							
All but NW ¹	State Forestry Dept.	L. Harter	Q	6/17-6/24	23	18	41
Douglas Co.	" " "	M. Easton	A	6/17-7/1	17	227	244
Josephine Co.	USFS	Crew: C. Wray J. Zeller P. Dinehart	C	6/17-6/20	17	30	47
Jackson Co.	Weyerhaeuser T. Co.	J. E. King	W	6/24	4	4	8
	" " "	C. Price	W	6/24	3	4	7
	" " "	J. Miles & J. E. King	W	7/1	2	1	3
Willamette N. F.	USFS	Crew: D. Johnson E. Sullivan H. Haglund	B	6/23-6/27	24	32	56
Umpqua N. F.	"	"	B	6/16-6/22	7	53	60
Rogue River N. F.	"	Crew: C. Wray J. Zeller P. Dinehart	C		8	44	52
Western Oregon Subtotal					341	1557	1898

TABLE 9 - WESTERN WASHINGTON

Area	Agency	Observer(s)	Symbol	Examination Dates (Incl.)	No. Plots		
					Budworm Present	Budworm Absent	Total
Whatcom Co.	Wash Div. Forestry	O. M. Selstad	D	7/8-7/15	0	12	12
" "	" " "	G. S. Williams	E	7/8	0	7	7
" "	" " "	E. Horn	F	7/11	0	7	7
" "	" " "	C. Both	G	7/11	0	4	4
" "	" " "	E. H. Wilson	H	7/12-7/18	0	8	8
" "	" " "	G. Huleatt	I	7/8-7/11	0	16	16
" "	" " "	W. Wefer	J	7/8	0	8	8
Skagit Co.	" " "	R. Benham	K	7/8	0	6	6
" "	Weyerhaeuser T. Co.	A. Lindquist	L	7/8-7/15	0	52	52
Snohomish Co.	" " "	E. Lindley	M	7/14	0	4	4
" "	" " "	T. Yocom, &					
" "	Wash. Div. Forestry	P. Lauterbach	N	7/8	0	24	24
" "	Everett Pulp & Paper Co.	H. Knutson	O	7/8-7/15	0	34	34
" "	Wash. Forestry Coop.	J. C. Robinson	P	7/12-7/13	0	7	7
Kitsap Co.	Pope & Talbot Co.	R. F. Smith	S	7/12	0	6	6
" "	Wash. Div. Forestry	R. E. Rheinboger	Q	7/13	0	11	11
" "		L. Tucker &	Z	7/12-7/15	0	18	18
Jefferson Co.	Pope & Talbot Co.	D. R. Taylor	R	7/13	0	11	11
" "	Crown-Zellerbach	C. H. Willison	BB	7/19	0	13	13
Mason Co.	Simpson Logging Co.	- Hillman &	CC	7/12-7/14	0	84	84
Grays Harbor Co.	Weyerhaeuser T. Co.	J. Miles &	DD	7/8-7/9	0	13	13
" " "	" " "	R. Ramstad					
" " "	" " "	J. Miles	EE	7/8	0	11	11
" " "	Rayonier Inc.	R. C. Carlson	FF	7/12-7/19	0	28	28
" " "	Simpson Logging Co.	W. S. Looney	GG	7/12-7/16	0	58	58

TABLE 9 - WESTERN WASHINGTON (Cont'd.)

Area	Agency	Observer(s)	Symbol	Examination Dates (Incl.)	No. Plots		
					Budworm Present	Budworm Absent	Total
King Co.	Wash. Div. Forestry	J. W. Ridgeway	T	7/12-7/13	0	18	18
" "	" " "	L. Morton	U	7/12-7/13	0	14	14
" "	" " "	R. Morgan	V	7/12	0	14	14
" "	Seattle Water Dept.	A. Thompson	W	7/14	0	10	10
" "	Weyerhaeuser T. Co.	- Dizard - Ellis A. Smyth	X	7/7-7/8	0	27	27
Pierce Co.	" " "	- Dizard, Ellis & Smith	X	7/7-7/8	3	20	23
" "	St. Paul Tacoma Lbr. Co.	J. T. Marsh	AA	7/13	0	19	19
" "	Weyerhaeuser T. Co.	J. Miles	EE	7/16	0	23	23
" "	Wash. Div. Forestry	W. Bartels	II	6/29	0	5	5
" "	" " "	W.H. Blanchard	JJ	6/30	0	8	8
" "	" " "	W. E. Philips & F. Hart	Y	7/8-7/14	0	10	10
Thurston Co.	" " "	H. S. Ward	HH	7/12-7/14	0	35	35
" "	Weyerhaeuser T. Co.	J. E. King	KK	6/9	4	17	21
Lewis Co.	Wash. Div. Forestry	A.T. Maki	MM	7/1-7/8	0	99	99
" "	" " "	R. T. Bickford	NN	7/7	0	32	32
Cowlitz Co.	Weyerhaeuser T. Co.	R. H. Kummer	OO	6/30-7/5	3	60	63
" "	" " "	J. Downer	PP	6/30-7/5	6	27	33
" "	Long-Bell Lbr. Co.	R. Johnson	QQ	6/30-7/1	3	39	42
Clark Co.	Long-Bell Lbr. Co.	W. H. Daudistel	RR	7/5	0	9	9
Wahkiakum Co.	Weyerhaeuser T. Co.	D. N. Jeffers	SS	6/29	0	16	16
" "	Crown-Zellerbach	E. A. Erickson	TT	7/22	0	30	30
Mt. Baker N. F.	Wash. Div. Forestry	C. Neth	UU	7/22	0	6	6
Olympic N. F.	"	Crew: J. Hunt J. Hultgren R. McCartney	A	6/29-7/1	6	30	36
Snequalmie N.F.	"	Crew: J. Hunt J. Hultgren R. McCartney	A	6/24-6/27	3	28	31
Columbia N.F.	"	Above Crew	A	6/17-6/21	0	38	38
Mt. Rainier Park	"	" "	A	6/21	1	1	2
Ft. Lewis Mil. Res.	"	Crew: D. Johnson, E. Sullivan, H. Haglund	B	7/20-7/22	2	37	39
				Subtotal	31	1141	1172

TABLE 10 - EASTERN WASHINGTON

Area	Agency	Observer(s)	Symbol	Examination Dates (Incl.)	No. Plots		
					Budworm Present	Budworm Absent	Total
Colville Ind. Res.	USFS	Crew: J. Hunt J. Hultgren R. McCartney	A	7/14-7/15	15	14	29
Chelan N. F.	"	"	"	7/11-7/13	35	10	45
Wenatchee N. F.	"	"	"	7/5-7/8	36	5	41
Snoqualmie N. F.	"	"	"	6/28	7	1	8
Columbia N. F.	"	Crew: D. Johnson E. Sullivan H. Haglund	B	7/7-7/8	0	22	22
Yakima Ind. Res.	"	"	"	7/8-7/13	18	29	47
Klickitat Co.	"	"	"	7/14-7/15	0	26	26
				Subtotal	111	107	218
				TOTAL ALL AREAS	672	2,962	3,634

GENERAL SAMPLING INSTRUCTIONS

SPRUCE BUDWORM SURVEY 1949

Samples to be taken at intervals of about one to three miles along route of travel, depending upon variations in stand structure, exposure, and elevation. Samples to be taken at least 200 feet from dusty roads or other disturbed locations.

Collection of budworm brood stages to be made at one sampling area in each main drainage. Approximately 5 larvae, pupae, or pupal cases from each collection point to be placed in provided vials and labeled by symbol corresponding to sampling area.

Location of samples to be plotted by number on maps and submitted with completed form and insect collections to:

Eastern Lane Fire Patrol
3150 Main Street
Springfield, Oregon.

1949 SPRUCE BUDWORM SURVEY

Date Unit Sheet No.

INSTRUCTIONS FOR USING
SPRUCE BUDWORM SURVEY FORM

Symbol - Insert letter assigned by supervisor to each observer or survey crew.

Sample No. Each observer numbers samples starting with 1. Numbers to run consecutively to end of survey.

Tree Spp. - Species of tree. DF = Douglas Fir;
TF = True Fir.

Stand Age - Designate age of stand by symbol : O = Old Growth; S = Second Growth; R = Reproduction. Designation to be applied to surrounding stand rather than to trees from which sample was taken.

No. Infest. Buds - The total number of attacked buds from three 15-inch sprays from each of 3 trees at each collection point to be counted and recorded. Webbed needles and evidences of defoliation to be counted whether or not brood is present.

Brood Stage - Number of budworm larvae, pupae, or empty pupal cases to be recorded for each sample area. Use the following symbols: L = Larvae; P = Pupae; F.C. = Pupal cases.

Infest. Pres. or Absent - Following the random sample, additional observations to be made at collection points to determine presence or absence of infestations. P = Present; A = Absent.

Remarks - These are most important. Special observations as to infestation indications that might be seen from the air - color of affected foliage, intensity of feeding, general appearance of a stand from a distance. Indicate whether insects were collected.

